23RD INTERNATIONAL EXPERTS SYMPOSIUM

CRITICAL ISSUES in aortic endografting 2019

LIVERPOOL UNITED KINGDOM MAY 23-24

LSA – when and why should we bother?

Michael Jenkins

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Disclosure

Speaker name:

MP Jenkins.....

☐ I have the following potential conflicts of interest to report:

☒ X Consulting Terumo Aortic/Gore/Bayer

☐ Employment in industry

☐ Shareholder in a healthcare company

☐ Owner of a healthcare company

☐ Other(s)

☐ I do not have any potential conflict of interest

What do we know?

- Left subclavian artery vs internal iliac

What do we know?

- Left subclavian artery vs internal iliac
- Annoying vessels at the extreme of conventional landing zones?
- Important collateral supplies of the spinal cord/brain?
- Pelvis vs left arm?

What are we told?

Eur J Vasc Endovasc Surg (2017) 53, 4—52

Editor's Choice — Management of Descending Thoracic Aorta Diseases

Clinical Practice Guidelines of the European Society for Vascular Surgery (ESVS)

Writing Committee [a] **V. Riambau, D. Böckler, J. Brunkwall, P. Cao, R. Chiesa, G. Coppi, M. Czerny, G. Fraedrich, S. Haulon, M.J. Jacobs, M.L. Lachat, F.L. Moll, C. Setacci, P.R. Taylor, M. Thompson, S. Trimarchi, H.J. Verhagen, E.L. Verhoeven,**
ESVS Guidelines Committee [b] **P. Kolh, G.J. de Borst, N. Chakfé, E.S. Debus, R.J. Hinchliffe, S. Kakkos, I. Koncar, J.S. Lindholt, M. Vega de Ceniga, F. Vermassen, F. Verzini,**
Document Reviewers [c] **P. Kolh, J.H. Black III, R. Busund, M. Björck, M. Dake, F. Dick, H. Eggebrecht, A. Evangelista, M. Grabenwöger, R. Milner, A.R. Naylor, J.-B. Ricco, H. Rousseau, J. Schmidli**

Keywords: Clinical practice, Descending thoracic aorta, Descending thoracic aortic management, Guideline, Recommendations, Thoracic aorta abnormalities, Thoracic aorta diseases, Thoracic aorta disorders, Thoraco-abdominal aorta

Recommendation 11	Class	Level of evidence	References
In elective thoracic endografting cases when it is planned to intentionally cover the left subclavian artery, in patients at risk of neurological complications, preventive left subclavian artery revascularisation should be considered	IIa	C	44

What are we told?

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Recommendation 23	**Class**	**Level of evidence**	**References**
In patients with ruptured descending thoracic aortic aneurysm, endovascular repair should be the first treatment option when the anatomy is appropriate	I	B	127
Recommendation 24			
In emergency ruptured descending thoracic aortic aneurysm in patients with a patent left mammary to coronary bypass or with a dominant or single left vertebral artery, left subclavian artery revascularisation should be performed prior to left subclavian artery coverage	I	C	49

What are we told?

JVS Journal of Vascular Surgery
Official Publication of the Society for Vascular Surgery

< Previous Article | November 2009 Volume 50, Issue 5, Pages 1155–1158 | Next Article >

The Society for Vascular Surgery Practice Guidelines: Management of the left subclavian artery with thoracic endovascular aortic repair

Jon S. Matsumura, MD[a,*], W. Anthony Lee, MD[b], R. Scott Mitchell, M
Mohammad Hassan Murad, MD, MPH[e], Alan B. Lumsden, MD[f], Roy K. Gre
Ronald M. Fairman, MD[i] Society for Vascular Surgery

Recommendations

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Prospective randomized trials directly comparing a selective strategy of LSA revascularization and routine LSA revascularization as well as other techniques of neuroprotection are unavailable and are needed. The following recommendations are based on systematic review of the literature:

- **Recommendation 1:** In patients who need elective TEVAR where achievement of a proximal seal necessitates coverage of the LSA, we suggest routine preoperative revascularization despite the very low-quality evidence (GRADE 2, level C).
- **Recommendation 2:** In selected patients who have an anatomy that compromises perfusion to critical organs, routine preoperative LSA revascularization is strongly recommended despite the very low-quality evidence (GRADE 1, level C).
- **Recommendation 3:** In patients who need very urgent TEVAR for life-threatening acute aortic syndromes where achievement of a proximal seal necessitates coverage of the LSA, we suggest that revascularization should be individualized and addressed expectantly on the basis of anatomy, urgency, and availability of surgical expertise (GRADE 2, level C).

What do we know?

- TEVAR is complicated by a stroke risk

Cardiovascular Surgery

Aortic Pathology Determines Midterm Outcome After Endovascular Repair of the Thoracic Aorta

Report From the Medtronic Thoracic Endovascular Registry (MOTHER) Database

Benjamin Patterson, BSc, MRCS; Peter Holt, PhD, FRCS; Chrisoph Nienaber, MD; Richard Cambria, MD; Ronald Fairman, MD; Matt Thompson, MD, FRCS

Background—Endovascular repair of the thoracic aorta has become an increasingly utilized therapy. Although the short-term mortality advantage over open surgery is well documented, late mortality and the impact of presenting pathology on long-term outcomes remain poorly reported.

Methods and Results—A database was built from 5 prospective studies and a single institutional series. Rates of perioperative adverse events were calculated, as were midterm death and reintervention rates. Multivariate analysis was performed with the use of logistic regression modeling. Kaplan-Meier survival curves were drawn for midterm outcomes. The database contained 1010 patients: 670 patients with thoracic aortic aneurysm, 195 with chronic type B aortic dissection, and 114 with acute type B aortic dissection. Lower elective mortality was observed in patients with chronic dissections (3%) compared with patients with aneurysms (5%). Multivariate analysis identified age, mode of admission, American Society of Anesthesiologists grade, and pathology as independent predictors of 30-day death ($P<0.05$). In the midterm, the all-cause mortality rate was 8, 4.9, and 3.2 deaths per 100 patient-years for thoracic aortic aneurysm, acute type B aortic dissection, and chronic type B aortic dissection, respectively. The rates of aortic-related death were 0.6, 1.2, and 0.4 deaths per 100 patient-years for thoracic aortic aneurysm, acute type B aortic dissection, and chronic type B aortic dissection, respectively.

Conclusions—This study indicated that the midterm outcomes of endovascular repair of the thoracic aorta are defined by presenting pathology, associated comorbidities, and mode of admission. Nonaortic mortality is high in the midterm for patients with thoracic aortic aneurysm, and managing modifiable risk factors appears vital. Endovascular repair of the thoracic aorta results in excellent midterm protection from aortic-related mortality, regardless of presenting pathology. (***Circulation***. **2013;127:24-32.**)

Key Words: acute aortic syndrome ■ aneurysm ■ aortic dissection ■ endovascular surgery ■ pathology

What do we know?

- TEVAR is complicated by a stroke risk

Eur J Vasc Endovasc Surg. 2017 Feb;53(2):176-184. doi: 10.1016/j.ejvs.2016.10.025. Epub 2016 Dec 18.

Editor's Choice - Incidence of Stroke Following Thoracic Endovascular Aortic Repair for Descending Aortic Aneurysm: A Systematic Review of the Literature with Meta-analysis.

von Allmen RS[1], Gahl B[2], Powell JT[3].

Author information

Abstract

OBJECTIVE: Stroke is an increasingly recognised complication following thoracic endovascular aortic repair (TEVAR). The aim of this study was to systematically synthesise the published data on perioperative stroke incidence during TEVAR for patients with descending thoracic aneurysmal disease and to assess the impact of left subclavian artery (LSA) coverage on stroke incidence.

METHODS: A systematic review of English and German articles on perioperative (in-hospital or 30 day) stroke incidence following TEVAR for descending aortic aneurysm was performed, including studies with ≥50 cases, using MEDLINE and EMBASE (2005-2015). The pooled prevalence of perioperative stroke with 95% CI was estimated using random effect analysis. Heterogeneity was examined using I^2 statistic.

RESULTS: Of 215 studies identified, 10 were considered suitable for inclusion. The included studies enrolled a total of 2594 persons (61% male) between 1997 and 2014 with a mean weighted age of 71.8 (95% CI 71.1-73.6) years. The pooled prevalence for stroke was 4.1% (95% CI 2.9-5.5) with moderate heterogeneity between studies (I^2 = 49.8%, p = .04). Five studies reported stroke incidences stratified by the management of the LSA, that is uncovered versus covered and revascularised versus covered and not-revascularised. In cases where the LSA remained uncovered, the pooled stroke incidence was 3.2% (95% CI 1.0-6.5). There was, however, an indication that stroke incidence increased following LSA coverage, to 5.3% (95% CI 2.6-8.6) in those with a revascularisation and 8.0% (95% CI 4.1-12.9) in those without revascularisation.

CONCLUSION: Stroke incidence is an important morbidity after TEVAR, and probably increases if the LSA is covered during the procedure, particularly in those without revascularisation.

What do we know?

- TEVAR is complicated by a stroke risk
- TEVAR with LSA coverage increases the risk

Left subclavian artery coverage during thoracic endovascular aortic repair and risk of perioperative stroke or death.

Chung J[1], Kasirajan K, Veeraswamy RK, Dodson TF, Salam AA, Chaikof EL, Corriere MA.

Author information

Abstract

INTRODUCTION: Left subclavian artery (LSA) coverage during thoracic endovascular aortic repair (TEVAR) is often necessary due to anatomic factors and is performed in to up to 40% of procedures. Despite the frequency of LSA coverage during TEVAR, reported associations with risk of periprocedural stroke or death are inconsistent in reported literature. We examined the 2005-2008 American College of Surgeons National Surgical Quality Improvement Program Participant Use Data file to determine associations between LSA coverage during TEVAR and risk of perioperative stroke or death.

METHODS: Current procedural terminology (CPT) codes were used to identify patients undergoing TEVAR, LSA coverage, and subclavian revascularization. Patients undergoing coronary bypass, ascending aortic repair, abdominal aortic aneurysm repair, or nonvascular intra-abdominal procedures during the same operation were excluded. Perioperative stroke and mortality associations with LSA coverage were examined using logistic regression models for each outcome. Significance was assessed at $\alpha = 0.05$, with univariable $P < .05$ required for multivariable model entry.

RESULTS: Eight hundred forty-five TEVAR procedures were identified, of which 52 patients were excluded due to

CONCLUSION: LSA coverage during thoracic endovascular repair is associated with increased risk of perioperative stroke following TEVAR. Further evidence is needed to determine whether procedural modifications, including LSA revascularization, reduce the incidence of stroke associated with TEVAR.

Eur J Vasc Endovasc Surg (2017) 53, 4—52

Eur J Vasc Endovasc Surg (2017) 53, 4—52

What else do we know?

- Mandatory indications for LSA revascularization:
  - Patent LIMA
  - Functioning dialysis access L arm
  - Dominant L vertebral artery
  - Extensive aortic coverage

What don't we know?

- Is LSA coverage just a surrogate for more proximal disease?
- Are strokes embolic or hypoperfusion related?
- Are they anterior or posterior territory?
- Are they disease related?

What else don't we know?

- Should revascularisation be open or endo?
- If open – bypass or transposition?

Why don’t we know?

J Endovasc Ther. 2016 Aug;23(4):634-41. doi: 10.1177/1526602816651417. Epub 2016 May 25.

Meta-analysis of Left Subclavian Artery Coverage With and Without Revascularization in Thoracic Endovascular Aortic Repair.

Hajibandeh S[1], Hajibandeh S[1], Antoniou SA[2], Torella F[1], Antoniou GA[3].

Author information

Abstract

PURPOSE: To examine the role of left subclavian artery (LSA) revascularization in thoracic endovascular aortic repair (TEVAR) with LSA coverage.

METHODS: A systematic search was conducted to identify all studies providing comparative outcomes with or without LSA revascularization for LSA occlusion during TEVAR. The search included MEDLINE, EMBASE, CINAHL, the Cochrane Central Register of Controlled Trials, the World Health Organization International Clinical Trials Registry, ClinicalTrials.gov, ISRCTN Register, and bibliographic reference lists. The primary outcome parameters were perioperative stroke, spinal cord ischemia (SCI), and mortality. Combined overall effect sizes were calculated using fixed effect or random effects models; results are reported as the odds ratio (OR) and 95% confidence interval (CI).

RESULTS: Five observational studies reporting a total of 1161 patients were identified; 444 patients underwent LSA revascularization and the remaining 717 patients did not. LSA revascularization was associated with a similar risk of stroke (OR 0.70, 95% CI 0.43 to 1.14, p=0.15), SCI (OR 0.56, 95% CI 0.28 to 1.10, p=0.09), and mortality (OR 0.87, 95% CI 0.55 to 1.39, p=0.56) compared with no LSA revascularization.

CONCLUSION: LSA revascularization was not found to significantly reduce neurologic complications or mortality in patients undergoing TEVAR with coverage of the LSA origin. Randomized clinical trials are required to elucidate the role of routine or selective LSA revascularization in these cases.

REVIEWS

Left Subclavian Arterial Coverage and Stroke During Thoracic Aortic Endografting: A Systematic Review

Stephen D. Waterford, MD, MS, Daisy Chou, MD, René Bombien, MD, PhD, Isil Uzun, MD, Aamir Shah, MD, and Ali Khoynezhad, MD, PhD

Department of Cardiovascular Surgery, Cedars-Sinai Medical Center, Los Angeles, California

Stroke is a devastating complication of thoracic endovascular aortic repair (TEVAR). Whether left subclavian artery (LSA) coverage and LSA revascularization affect stroke rate is debated. Whether patients with aneurysms or dissections undergoing TEVAR have higher stroke rates is also debated. We report a systematic review of 63 studies comprising more than 3,000 patients. We conclude that stroke risk after TEVAR is increased by LSA coverage, and that LSA revascularization reduces stroke risk. LSA revascularization may lower the rate of posterior stroke. TEVAR for aneurysm is associated with increased stroke risk compared to TEVAR for dissection.

(Ann Thorac Surg 2016;101:381–9)

Why don't we know?

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(Ann Thorac Surg 2016;101:381–9)

In conclusion, stroke after TEVAR is a devastating event that can lead to permanent neurologic disability and mortality. This systematic review shows that LSA coverage is associated with increased overall stroke rate. Furthermore, LSA coverage without revascularization may increase stroke rate compared to coverage with revascularization, and LSA revascularization may lower the rate of posterior stroke. Many aortic programs have a selective revascularization policy, and therefore the occurrence of posterior strokes in the nonrevascularized group suggests that it is difficult to preoperatively identify all patients who would benefit from LSA revascularization. This review suggests that posterior stroke may be a complication of LSA coverage, associated with high permanent disability and mortality. While retrospective literature analysis has its limitations, the findings of this review provide support for routine revascularization of the LSA in elective cases.

Why don't we know?

Table 3

Anatomic Distribution of Strokes Following LSA Coverage

First Author, Year	Number of Nonrevascularized Patients With LSA Coverage	Anterior Strokes	Posterior Strokes	Number of Revascularized Patients With LSA Coverage	Anterior Strokes	Posterior Strokes
Feezor 2009 [20]	19	2/19 (10.5%)	2/19 (10.5%)	3	0/3 (0%)	0/3 (0%)
Guangqi 2009 [21]	36	1/36 (2.8%)	1/36 (2.8%)	1	0/1 (0%)	0/1 (0%)
Holt 2010 [22]	39	4/39 (10.3%)	1/39 (2.6%)	13	0/13 (0%)	0/13 (0%)
Kaya 2009 [23]	13	2/13 (15.4%)	0/13 (0%)	1	0/1 (0%)	0/1 (0%)
Kotelis 2009 [25]	66	2/66 (3.0%)	0/66 (0%)	22	1/22 (4.5%)	0/22 (0%)
Lee 2011 [26]	113	3/113 (2.7%)	1/113 (0.9%)	32	1/32 (3.1%)	0/32 (0%)
Marcheix 2006 [28]	6	1/6 (16.7%)	0/6 (0%)	1	0/1 (0%)	0/1 (0%)
Mariscalco 2009 [29]	15	0/15 (0%)	3/15 (20%)	12	0/12 (0%)	1/12 (8.3%)
Peterson 2006 [35]	8	2/8 (25%)	2/8 (25%)	22	0/22 (0%)	0/22 (0%)
Reece 2007 [37]	20	2/20 (10%)	0/20 (0%)	7	1/7 (14.3%)	0/7 (0%)
Riesenman 2007 [38]	24	3/24 (12.5%)	0/24 (0%)	NA	NA	NA
Woo 2008 [42]	28	3/28 (10.7%)	0/28 (0%)	42	3/42 (7.1%)	0/42 (0%)

- Variables:
  - Partial coverage
  - Stroke distribution
  - Aneurysm or dissection
  - MAP
  - Anti-platelet/statin…..

Why don’t we know?

Cochrane Database Syst Rev. 2016 Apr 27;4:CD011738. doi: 10.1002/14651858.CD011738.pub2.

Revascularisation of the left subclavian artery for thoracic endovascular aortic repair.

Hajibandeh S[1], Hajibandeh S, Antoniou SA, Torella F, Antoniou GA.

⊕ **Author information**

Abstract

BACKGROUND: Controversy exists as to whether revascularisation of the left subclavian artery (LSA) confers improved outcomes in patients undergoing thoracic endovascular aortic repair (TEVAR). Even though preemptive revascularisation of the LSA has theoretical advantages, including a reduced risk of ischaemic damage to vital organs, such as the brain and the spinal cord, it is not without risks. Current practice guidelines recommend routine revascularisation of the LSA in patients undergoing elective TEVAR where achievement of a proximal seal necessitates coverage of the LSA, and in patients who have an anatomy that compromises perfusion to critical organs. However, this recommendation was based on very low-quality evidence.

OBJECTIVES: To assess the comparative efficacy of routine LSA revascularisation versus either selective or no revascularisation in patients with descending thoracic aortic disease undergoing TEVAR with coverage of the LSA origin.

SEARCH METHODS: The Cochrane Vascular Trials Search Co-ordinator (TSC) searched the Specialised Register (June 2015). In addition, the TSC searched the Cochrane Register of Studies (CENTRAL (2015, Issue 5)).Trials databases were also searched (June 2015).

SELECTION CRITERIA: We had planned to consider all randomised controlled trials (RCTs) that compared routine revascularisation of the LSA with selective or no revascularisation, in patients undergoing TEVAR.

DATA COLLECTION AND ANALYSIS: Two review authors independently assessed the title and abstract of articles identified through literature searches. An independent third review author was consulted in the event of disagreement. We had planned for two review authors to independently extract data and assess the risk of bias of identified trials using the criteria recommended in the Cochrane Handbook for Systematic Reviews of Interventions.

MAIN RESULTS: We did not identify any RCTs relevant to our review topic. Therefore, no quantitative analysis was conducted.

AUTHORS' CONCLUSIONS: High quality RCT evidence for or against routine or selective revascularisation of the LSA in TEVAR is not currently available. It is not possible to draw conclusions with regard to the optimal management of LSA coverage in TEVAR, and whether routine revascularisation, which was defined as the intervention of interest in our review, confers beneficial effects, as indicated by reduced mortality, cerebrovascular events, and spinal cord ischaemia. This review highlights the need for continued research to provide RCT evidence and define the role of LSA revascularisation in the context of TEVAR with coverage of the LSA.

Why don’t we know?

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Case series data

Left subclavian artery revascularization in zone 2 thoracic endovascular aortic repair is associated with lower stroke risk across all aortic diseases.

Bradshaw RJ[1], Ahanchi SS[1], Powell O[1], Larion S[1], Brandt C[1], Soult MC[1], Panneton JM[2].

Author information

Abstract

BACKGROUND: The best management strategy for the left subclavian artery (LSA) in pathologic processes of the aorta requiring zone 2 thoracic endovascular aortic repair (TEVAR) remains controversial. We compared LSA coverage with or without revascularization as well as the different means of LSA revascularization.

METHODS: A retrospective chart review was conducted of patients with any aortic diseases who underwent zone 2 TEVAR deployment from 2007 to 2014. Primary end points included 30-day stroke and 30-day spinal cord injury (SCI). Secondary end points were 30-day procedure-related reintervention, freedom from aorta-related reintervention, aorta-related mortality, and all-cause mortality.

RESULTS: We identified 96 patients with zone 2 TEVAR who met our inclusion criteria. The mean age of the patients was 62 years, with 61.5% male. Diseases included acute aortic dissections (n = 25), chronic aortic dissection with aneurysmal degeneration (n = 22), primary aortic aneurysms (n = 21), penetrating aortic ulcers/intramural hematomas (n = 17), and traumatic aortic injuries (n = 11). Strategies for the LSA included coverage with revascularization (n = 54) or without revascularization (n = 42). Methods of LSA revascularization included laser fenestration with stenting (n = 33) and surgical revascularization: transposition (n = 10) or bypass (n = 11). Of the 54 patients with LSA revascularization, 44 (81.5%) underwent LSA intervention at the time of TEVAR and 10 (18.5%) at a mean time of 33 days before TEVAR (range, 4-63 days). For the entire cohort, the overall incidence of 30-day stroke was 7.3%; of 30-day SCI, 2.1%; and of procedure-related reintervention, 5.2%. At a mean follow-up of 24 months (range, 1-79 months), aorta-related reintervention was 15.6%, aorta-related mortality was 12.5%, and all-cause mortality was 29.2%. The 30-day stroke rate was highest for LSA coverage without revascularization (6/42 [14.3%]) compared with any form of LSA revascularization (1/54 [1.9%]; P = .020), with no difference between LSA interventions done synchronously with TEVAR (1/44 [2.3%]) vs metachronously with TEVAR (0/10 [0%]; P = .63). There was no significant difference in 30-day SCI in LSA coverage without revascularization (2/42 [4.8%]) vs with revascularization (0/54 [0%]; P = .11). There was no difference in aorta-related reintervention, aorta-related mortality, or all-cause mortality in coverage without revascularization (5/42 [11.9%], 6/42 [14.3%], and 14/42 [33.3%]) vs with revascularization (10/54 [18.5%; P = .376], 6/54 [11.1%; P = .641], and 14/54 [25.9%; P = .43], respectively). After univariate and multivariable analysis, we identified LSA coverage without revascularization as associated with a higher rate of 30-day stroke (hazard ratio, 17.2; 95% confidence interval, 1.3-220.4; P = .029).

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CONCLUSIONS: Our study suggests that coverage of the LSA without revascularization increases the risk of stroke and possibly SCI.

Registry data

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Outcome Comparison of TEVAR with and without Left Subclavian Artery Revascularization from Analysis of Nationwide Inpatient Sample Database.

Delafontaine JL[1], Hu B[2], Tan TW[3], Tang GL[4], Starnes BW[4], Virk C[1], Chow WB[4], Zhang WW[5].

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Abstract

BACKGROUND: The purpose of this study was to compare the outcomes of thoracic endovascular aortic repair (TEVAR) without and with left subclavian artery (LSA) revascularization using the Nationwide Inpatient Sample (NIS) database.

METHODS: NIS records from 2005 to 2013 were retrospectively analyzed to identify patients undergoing TEVAR without and with LSA revascularization. Perioperative outcomes were compared between the two groups. The LSA revascularization group was further subdivided to compare perioperative outcomes if the revascularization was performed pre- or post-TEVAR or if the revascularization was performed open versus endovascular. Comparisons were examined using univariable analysis and multivariable logistic regression. Multivariable models were constructed using a forward selection approach with $P < 0.05$ required for model entry. Odds ratios are expressed per standard deviation change for continuous covariates. Continuous variables were compared between different groups using t-test, and categorical variables were compared using the chi-squared test. All statistical analyses were performed using R (cran.r-project.org).

RESULTS: 7,773 TEVAR patients were included in this study. 6,411 (82.5%) were performed without and 1,362 (17.5%) with LSA revascularization. The rate of revascularization for LSA coverage during TEVAR doubled after the Society for Vascular Surgery Guidelines recommending revascularization were published in 2009. Groups were not significantly different in age (65.5 ± 15.8 and 66.1 ± 14.4 years old, respectively), gender, or race. Multivariable analysis showed that although rates of spinal cord ischemia and upper extremity ischemia were similar, perioperative cardiac complications (OR 1.5, 95% CI [1.2, 1.9], $P = 0.025$), stroke (OR 2.1, 95% CI [1.6, 2.8], $P = 0.001$), and pulmonary complications (OR 1.9, 95% CI [1.7, 2.3], $P < 0.001$) were significantly higher in the patients undergoing TEVAR with LSA revascularization than those without. Of the 1,362 patients with LSA revascularization, 1,251 (91.9%) were performed pre-TEVAR and 111 (8.1%) were performed post-TEVAR. Among the 1,251 patients with pre-TEVAR LSA revascularization, 583 had open surgery and 553 had stenting. In 115 patients, LSA revascularization was coded as both open and endovascular. Compared with pre-TEVAR revascularization, post-TEVAR revascularization was associated with higher risks of pulmonary complications and spinal cord ischemia. Endovascular LSA revascularization had lower pulmonary and stroke morbidity versus open LSA revascularization. The perioperative outcomes for the LSA revascularization subgroups are summarized.

CONCLUSIONS: TEVAR with LSA revascularization is associated with significantly increased rates of perioperative stroke and cardiopulmonary complications. LSA revascularization before TEVAR, compared with post-TEVAR revascularization, had lower perioperative complications. In high-risk patients, endovascular LSA revascularization may be recommended over open surgery.

Registry data

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Registry data

Stroke following Thoracic Endovascular Aortic Repair and the Impact of Left Subclavian Artery Management

Introduction: Stroke is a devastating complication following thoracic endovascular aortic repair (TEVAR). Studies have found conflicting results on stroke risk following TEVAR with concurrent left subclavian artery (LSA) coverage alone (pooled reported rates ranging between 4.7-7.8%) and whether LSA revascularization results in lower stroke rates (pooled reported rates ranging between 4.1-5.8%). Therefore, we compared stroke rate following TEVAR with differing LSA management strategies in the real-world setting of a nationwide clinical registry.

Methods We identified all patients undergoing non-emergent TEVAR and/or open LSA revascularization within a nationwide clinical registry between 2005-2017. We compared outcomes between TEVAR with vs. without LSA coverage, TEVAR with LSA coverage with vs. without revascularization, and isolated LSA revascularizations for thoracic aneurysm/dissection vs. occlusive disease. The primary outcome was 30-day stroke. Multivariable logistic regression was used to adjust for baseline differences and identify factors associated with stroke following TEVAR.

Results We identified 2,346 TEVARs,1,458 without LSA involvement, 660 with coverage alone, and 228 with both LSA coverage and revascularization. Additionally, we identified 768 isolated LSA revascularizations for occlusive disease and 395 isolated revascularizations for thoracic aneurysm/dissection. Overall, 79 (3.4%) patients undergoing TEVAR experienced a stroke: 2.3% following TEVAR without LSA involvement vs. 5.2% in those where the LSA was covered (P< .001). In TEVARs with coverage of the LSA, stroke rates were 7.5% when the LSA was concomitantly revascularized vs. 4.4% without revascularization (P=.072). During the same study period, isolated LSA revascularization for thoracic aneurysm/dissection demonstrated a stroke rate of 3.8% vs. 0.5% for those for occlusive indications (P< .001). Thirty-day mortality in TEVAR-patients experiencing stroke was 24% compared to 2.8% for those without stroke (P< .001). After risk-adjustment, coverage of the LSA was associated with higher stroke rates (odds ratio: 2.0; 95% CI: 1.2-3.4; P=.006), and in TEVARs with coverage, odds of stroke were higher in those undergoing concomitant LSA revascularization (1.9; 95%CI: 1.005-3.6; P=.048). Other preoperative factors independently associated with stroke after TEVAR were dyspnea (1.8; 95%CI: 1.1-3.0; P=.014), renal dysfunction (2.0; 95%CI: 1.003-3.8; P=.049), and elevated international normalized ratio (3.6; 95%CI: 1.03-13; P=.045).

	All TEVAR procedures			LSA-Covered TEVARs only		
	No LSA-Coverage	LSA Covered		No LSA Revascularization	Concomitant LSA Revascularization	
	N (%)	N (%)	P-value	N (%)	N (%)	P-value
N	1,458	888		660	228	
Stroke	33 (2.3%)	46 (5.2%)	<.001	29 (4.4%)	17 (7.5%)	.072
30-Day Mortality	41 (2.8%)	42 (4.7%)	.015	29 (4.4%)	13 (5.7%)	.42
Major Complication	186 (13%)	179 (20%)	<.001	117 (18%)	62 (27%)	.002

[Univariate Analysis of Outcomes following TEVAR]

Conclusion Stroke following TEVAR with LSA coverage occurs more frequently in the real-world setting than reported in literature and concurrent LSA revascularization was not associated with lower stroke rates. Furthermore, stroke is strongly associated with perioperative death following TEVAR.

Reference

Registry data

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Open or endo revascularization?

J Endovasc Ther. 2018 Dec;25(6):740-749. doi: 10.1177/1526602818802581. Epub 2018 Oct 4.

Comparison of Two Different Techniques for Isolated Left Subclavian Artery Revascularization During Thoracic Endovascular Aortic Repair in Zone 2.

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⊕ **Collaborators (12)**

⊕ **Author information**

Abstract

PURPOSE: To analyze the results of isolated left subclavian artery (LSA) revascularization during thoracic endovascular aortic repair (TEVAR) using carotid-subclavian bypass (CSbp) or chimney grafts (CGs).

METHODS: A retrospective multicenter, observational study identified 73 patients (mean age 68±13 years, range 22-87; 56 men) with acute or chronic thoracic aortic lesions who underwent TEVAR with isolated LSA revascularization using either CSbp (n=42) or CGs (n=31) from January 2010 and February 2017. Primary endpoints were TEVAR-related mortality, postoperative stroke, freedom from type Ia endoleak, and LSA patency.

RESULTS: Primary technical success was achieved in all cases. Early TEVAR-related mortality was 4.2% (CSbp 2% vs CG 6%, p=0.571). Two (3%) patients had major ischemic strokes (one in each group). Mean follow-up was 24±21 months (range 1-72; median 15). Estimated freedom from TEVAR-related mortality was 93%±3% (95% CI 84.3% to 97.0%) at 12 and 36 months, with no significant difference between CSbp and CG (p=0.258). Aortic reintervention did not differ between the groups (CSbp 5% vs CG 6%, p=0.356); nor did freedom from type Ia endoleak (CSbp 98% vs CG 87%, p=0.134). Gutter-related endoleaks occurred in 4 (13%) CG patients, but none of the patients experienced sac enlargement or the need for reintervention and none died. Primary patency of the LSA was 100% for the entire group during the observation period.

CONCLUSION: In our experience, LSA revascularization proved most satisfactory and equally effective with both the CSbp and CG techniques, without discernible differences at midterm follow-up.

Mechanisms

Annals of Vascular Surgery

Impact of Left Subclavian Artery Revascularization before Thoracic Endovascular Aortic Repair on Postoperative Cerebrovascular Hemodynamics

Arnoud V. Kamman[1,2,3], Jonathan L. Eliason[4], David M. Williams[5], Bo Yang[3], Frans L. Moll[1], Santi Trimarchi[2], Kim A. Eagle[6], Himanshu J. Patel[3,*]

Results

Duplex confirmation of antegrade left vertebral artery (LVA) flow decreased significantly after TEVAR with LSA revascularization (100.0% vs. 77.9%, $P < 0.001$). Incidence of retrograde LVA flow increased from 0.0% to 8.3% ($P = 0.063$). Postoperatively, LVA bidirectional flow was observed in 3 patients (4.4%). Flow directions in the right vertebral artery (RVA) did not change significantly. Peak systolic velocity (PSV) in the LVA decreased significantly after TEVAR from 55.1 ± 22.0 cm/s to 35.9 ± 26.3 cm/s ($P < 0.001$). In contrast, PSV increased in the RVA and the right internal carotid artery (ICA; 52.2 ± 21.7 cm/s to 63.2 ± 23.3 cm/s, $P = 0.012$ and 95.3 ± 46.8 cm/s to 102.8 ± 42.9 cm/s, $P = 0.011$). PSV did not change significantly in the left ICA. At mean follow-up of 36.6 ± 26.8 months, primary bypass patency was 100.0%. Postoperatively, one case of temporary spinal cord ischemia was seen (1.4%). Stroke rate was 6.9% ($n = 5$, 100.0% embolic), all without permanent disabilities. Stroke circulation distribution was 60.0% posterior, 20.0% anterior, and 20.0% mixed. Location of stroke was left sided ($n = 2$) or in both hemispheres ($n = 3$). There were no deaths at 30 days. Neurological events during follow-up included 3 new strokes. All-cause mortality rate during follow-up was 12.2% ($n = 9$).

Conclusions

Adjunctive LSA revascularization in the setting of zone 2 TEVAR coverage is associated with hemodynamic vertebral artery changes. Future studies in larger sample sizes should evaluate whether these novel findings are an important determinant of postoperative neurologic events.

What can we conclude?

- Stroke risk remains
- Increases with more proximal seal
- Literature is confused:

What can we conclude?

- Stroke risk remains
- Increases with more proximal seal
- Literature is confused:
  - Territory and mechanism of stroke not reported
  - Indication for revascularization not clear
  - Stroke varies with pathology
  - Unclear if ‘mandatory’ indications were adhered to
  - Retrospective and registry data
  - Flow data shows variation despite revascularisation

Summary

- When:
  - All elective aneurysms
  - Most dissections
- When not:
  - Short coverage eg PAU/BAI
  - Emergency TEVAR
- Why bother:
  - Because it works